Bridge-to-Corn-Ethanol Subcontract Summary Sheet
Vogelbusch U.S.A.
Technical Advisor: M. Ruth

Industrial Partner: Chief Ethanol in Hastings, NE
Other Partners: Farmers, Kearney Area Ag. Producers Association (KAPPA)

Starch to Ethanol Process Information

Feedstock: Milo with some corn
Facility Capacity: 60,000,000 gal/yr
Ethanol Yield: Unknown
Other Products: DDGS

Biomass Process Information

Size of Biomass Process: 23.5 MM gal/yr = 850 dry tonne / day
Ethanol Yield: 300 L/dry tonne = 72.2 gal / dry ton
Feedstock: Corn Stover
Process: Co-current Dilute Acid Prehydrolysis and Enzymatic Hydrolysis
Fermentative Organism: Xylose Fermenting NREL Recombinant *Zymomonas mobilis*
Steam: Produced by biomass burner / turbogenerator
Electricity: Excess electricity is produced by the facility but no sales credit is taken for it.
Other Information: Cellulase enzyme is to be purchased from an external supplier

Links with Existing Facility

Alcohol Storage and Loadout Facilities
Lab Facilities, Maintenance, Management and Administrative Systems
Use of Steam for Start-up

Capital and Operating Costs

Biomass Plant Capital Investment: $152,458,559 = $6.50 / annual gallon
Total Operating Costs: ≈$1.20 / gal ethanol
Feedstock Cost: $44 / dry ton = $0.609 / gal ethanol
Chemical and Disposal Cost: $0.523 / gal ethanol ($0.30 / gal ethanol for purchased cellulase)

Proforma

Solved for Average Annual After-tax Income: ($22,110,269)
Equivalent to Average Annual Return of –14.5%
Ethanol Selling Price: $1.15 / gal
Plant Life: 12 years
Financing: 30% Equity – Loan at 10% with 15 year term
Depreciation: 15 year straight line

SensitivityAnalysis

Increased Yield 20%, Reduced Stover Price $10 / dry ton, Reduced Chemical Costs from ≈$0.50 / gal to $0.30 / gal, Reduced Fixed Capital Investment to $3.00 / annual gallon, Reduced Loan Rate to 8.5%
Solved for Average Annual Pre-tax Income: $126.286
Equivalent to Average Annual Return of 0.17%

Strengths of Subcontract

Design and Costing for Corn Stover Handling
Design and Costing of Vogelbusch Ethanol Separation Technology
Cost of Corn Stover Collection
Engineering Company Verification of Many Equipment Costs

Labor Requirement Calculations

Subcontract Recommendations/Next Steps

Research is necessary to reduce capital expenditure by 50%
Reduce overall chemical costs (including cellulase) by $0.20/gal ethanol
Improve alcohol yield by 20%
Reduce feedstock collection and transportation cost by $10 / dry ton.
Government grants or low rate loans are also needed to commercialize this technology.
Pilot Plant work is required with actual feedstocks
Determine Zymo's tolerance to process upsets
Develop alternative uses for lignin
Explore Sales of CO_2